CAVANAUGH
Stewardship Through Innovation

Water Audit Level 1 Validation Review Document

Validator Provided

Audit Information:

Utility: California City PWS ID: 1510032

System Type: Potable Audit Period: Calendar 2017

Utility Representation: Toby Layton, Art VanDang

Validation Date: 10/5/2018 Call Time: 8:30am Sufficient Supporting Documents Provided: Yes

Validation Findings & Confirmation Statement:

Key Audit Metrics:

Data Validity Score: 53 Data Validity Band (Level): Band III (51-70)

ILI: 3.39 Real Loss: 1,741.72 (gal/mile-main/day) Apparent Loss: 8.23 (gal/conn/day)

Non-revenue water as percent of cost of operating system: 5.5%

Certification Statement by Validator:

This water loss audit report has been Level 1 validated per the requirements of California Code of Regulations Title 23, Division 2, Chapter 7 and the California Water Code Section 10608.34.

All recommendations on volume derivation and Data Validity Grades were incorporated into the water audit. ☒

Validator Information:

Water Audit Validator: Larry Lewison, Will Jernigan P.E. Validator Qualifications: Contractor for California Water Loss TAP

#	AWWA Water Audit Input	Code	Final DVG	Basis on Input Derivation	Basis on Data Validity Grade
1	Volume from Own Sources	VOS	4	Supply meter profile: Total of 6 groundwater wells used in varying degrees for 2017. Water purchased from AVEK heavily supplements peak months. Volumes are tracked by daily manual reads and compared to SCADA recorded volumes. Meters are scheduled to be tested by manufacturer in 2018 and SCE is scheduled to perform pump efficiency tests in 2018. VOS input derived from: Manual reads from production meters as archived. Comments: Input derivation from supporting documents confirmed. Exclusion of non-potable volumes confirmed.	Percent of own supply metered: 100% Signal calibration frequency: None. Volumetric testing frequency: None. Volumetric testing method: n/a. Percent of own supply tested and/or calibrated: 0%. Comments: Meters replaced in 2016 and are reliably maintained. No testing in 2017. In situ testing is planned for 2018.
2	VOS Master Meter & Supply Error Adjustment	VOS MMSEA	2	Input derivation: Left blank in absence of available test data. Net storage change included in MMSEA input: No. Comments: 5 total storage tanks	Supply meter read frequency: Daily. Supply meter read method: Manual and automatic logging. Frequency of data review for trends & anomalies: Monthly. Storage levels monitored in real-time: Yes. Comments: No additional comments.
3	Water Imported	WI	2	Import meter profile: Purchase water from AVEK used all 12 months. WI input derived from: Totalization of volumes per redundant meter reads by utility. They read on a monthly basis, AVEK reviews the data once a month; they cross check their reads with invoices. Not connected to SCADA. Comments: Input derivation from supporting documents confirmed. Exclusion of non-potable volumes confirmed.	Percent of import supply metered: 100% Signal calibration frequency: Unsure. Volumetric testing frequency: Unsure. Volumetric testing method: Unsure. Percent of import supply volumetrically tested: n/a. Comments: No additional comments.
4	WI Master Meter & Supply Error Adjustment	WI MMSEA	2	Input derivation: Left blank in absence of available test data. Comments: No additional comments.	Import meter read frequency: Monthly. Import meter read method: Manual. Frequency of data review for trends & anomalies: Monthly. Comments: No additional comments.
5	Water Exported	WE	n/a	Comments: No other entities to tie into, so no connections exist.	
6	WE Master Meter & Supply Error Adjustment	WE MMSEA	n/a		
7	Billed metered	BMAC	6	Customer meter profile: Age profile: Oldest 30 to 40 years old, newest < 1 year. Currently about 60% completed with full meter replacement project. Reading system: Manual (older meters), AMR (newer meters)	Percent of customers metered: 100% Small meter testing policy: Reactive - complaint based or flagged-consumption testing only. Have a new bench test and

#	AWWA Water Audit Input	Code	Final DVG	Basis on Input Derivation	Basis on Data Validity Grade
				Read frequency: Monthly (3rd party). Comments: Lag-time correction is not employed in input derivation. Input derivation from supporting documents confirmed. Exclusion of non-potable volumes confirmed. Consumption increased considerable in 2017 thought to be directly related to new meters installed. Have a third-party agency to manually read meters until new AMR system is fully complete. Meter changeout proxy for testing will be valid through 2018 only. Currently filling City owned lake with drinking water and billed to parks and recreation.	now test the retired old meters and some new meters before installation. Number of small meters tested/year: 250 Large meter testing policy: Reactive - complaint based or flagged-consumption testing only. Number of large meters tested/year: 0 Meter replacement policy: Ongoing via meter conversion project at ~10% each year. Number of replacements/year: 626 Billing data auditing: Standard billing QC, plus review of volumes by use type each billing cycle. Financial auditor performs sampling review on select accounts each year. Comments: DVG of 6 based on using the meter changeout project as proxy for meter testing. Limited by routine auditing of detailed statistics.
8	Billed unmetered	BUAC	n/a	Comments: None reported for 2017.	
9	Unbilled metered	UMAC	n/a	Comments: All municipal accounts are read and billed.	
10	Unbilled unmetered	UUAC	5	Profile: Operational flushing and fire department usage. Comments: Custom California default of 0.25%xWS utilized.	Comments: Default grade applied. Consider expanding your current tracker of flushing volumes to cover all applicable uses of unbilled, unmetered. No leak volumes applied here.
11	Unauthorized consumption	UC	5	Comments: Default input applied.	Comments: Default grade applied.
12	Customer metering inaccuracies	CMI	4	See BMAC comments regarding meter testing & replacement activities. Input derivation: Inferred value was modified from 1.5% to 1.25% due to additional new meter installations. Comments: Consider using existing meter test results to develop a calculated volume for this input.	Characterization of meter testing: Routine (proactive), but not fully representative. Characterization of meter replacement: Routine (proactive) but limited. Comments: Retired meters are being tested.
13	Systematic data handling errors	SDHE	5	Comments: Default input applied. After discussion about the provided input number, it was determined input volume represented leak volumes particularly from a transmission main break during 2017. Input was changed to the default input.	Comments: Default grade applied.

#	AWWA Water Audit Input	Code	Final DVG	Basis on Input Derivation	Basis on Data Validity Grade
14	Length of mains	Lm	6	Input derivation: Totaled from CAD based map and old paper as-builts (new infrastructure from approximately last 12 years is in GIS, older areas are paper records). Hydrant leads included: Yes. Comments: No additional comments.	Mapping format: Digital (new areas only). Asset management database: Not currently in place. Map updates & field validation: Accomplished through normal work order processes. Comments: No additional comments.
15	Number of service connections	Ns	7	Input derivation: Standard report run from billing system (4,453 active connections, 756 inactive, totaling to 5,209). Basis for database query: Account ID - non-premise based. Comments: Removed 102 services at trailer park, replaced by master meter.	CIS updates & field validation: Accomplished through normal meter reading processes. Estimated error of total count within: 3%. Comments: No additional comments.
16	Ave length of cust. service line	Lp	10	Comments: Default input and grade applied, as customer meters are typically located at the property boundary given California climate.	
17	Average operating pressure	AOP	5	Number of zones, general profile: 1 major gravity zone 90%, 6 smaller pumped zones (so 7 total zones). Typical pressure range: 50-90 psi. Input derivation: Rudimentary estimate. Comments: Consider using existing SCADA information from pressure transducers in addition to field test pressure data to calculate a weighted average operating pressure.	Extent of static pressure data collection: n/a. Characterization of real-time pressure data collection: Basic - telemetry or pressure logging at boundary points (supply locations, tanks, PRVs, boosters). Hydraulic model: In place, but unsure of use and date of last field calibration. Comments: No additional comments.
18	Total annual operating cost	TAOC	10	Input derivation: From official financial reports. Comments: Confirmed costs limited to water only, and water debt service included.	Frequency of internal auditing: Annually. Frequency of third-party CPA auditing: Annually. Comments: No additional comments.
19	Customer retail unit cost	CRUC	8	Input derivation: Total consumptive revenue divided by Billed Metered Authorized Consumption. Commercial sewer charges are based on water meter readings. Sewer revenues are incorporated into calculation. Comments: Calculated from total water sales and commercial sewer sales divided by total billed metered volume.	Characterization of calculation: Composite via simple rate structure with only a single rate. Input calculations have not been reviewed by an M36 water loss expert. Comments: No additional comments.
20	Variable production cost	VPC	4	Supply profile: Own sources and import supply. Primary costs included: Treatment chemicals and supply & distribution power. Secondary costs included: None currently included.	Characterization of calculation: Primary costs only. Input calculations have not been reviewed by an M36 water loss expert. Comments: No additional comments.

#	AWWA Water Audit Input	Code	Final DVG	Basis on Input Derivation	Basis on Data Validity Grade
				Comments: Primary costs only. Power plus Chemical for VOS and purchase water from AVEK.	

Key Audit Metrics

(~) VALIDITY Data Validity Score: 53 Data Validity Band (Level): Band III (51-70)

(#) VOLUME ILI: 3.39 Real Loss: 1741.72 (gal/mile/day) Apparent Loss: 8.23 (gal/conn/day)

($) VALUE Annual Cost of Apparent Losses: $128,008 Annual Cost of Real Losses: $91,337

Infrastructure & Water Loss Management Practices:

Infrastructure age profile: 40-60 years old (started in 1960s). Infrastructure replacement policy (current, historic): Ongoing replacement.

Estimated main failures/year: 65 Estimated service failures/year: 265

Extent of proactive leakage management: They find leaks very easily due to non-absorbent ground (clay), so leaks come to surface quickly.

Other water loss management comments: No additional comments.

Comments on Audit Metrics & Validity Improvements

The Infrastructure Leakage Index (ILI) of 3.39 describes a system that experiences leakage at 3.39 times the modeled technical minimum for its system characteristics.

The Data Validity Score falling within Band III (51-70) suggests that next steps may be focused simultaneously on improving data reliability and evaluating cost-effective interventions for water & revenue loss recovery. Opportunities to improve the reliability of audit inputs and outputs include:

- Improved understanding of Supply Meter (Own and Import) Master Meter Error: consider adopting or increasing the rigor of a source meter volumetric testing and calibration program, informed by the guidance provided in AWWA Manual M36 – Appendix A.
- Improved estimation of CMI: consider a customer meter testing program which tests a sample of random meters whose stratification (by size, age, or other characteristics) represents the entire customer meter stock.
- Temporal alignment of Billed Metered Authorized Consumption with Water Supplied: consider pro-rating the first and last months of the audit period to better align consumption with actual dates of use, and using read date as basis for reporting.
- Customized estimate of Unbilled Unmetered Authorized Consumption: consider producing itemized, agency-specific estimates of unbilled unmetered (operational) uses, rather than using the default. Ensure leakage estimates are excluded.
- Level 2 validation on raw data for Billed Metered Authorized Consumption to determine and resolve any instances of potable volume duplication or non-potable volume inclusion.

Further Recommendations

Since Data Validity Score is >50, consider follow-on implementations as described in the AWWA M36 Manual, once the annual water audit is established:

- Conduct a Real Loss Component Analysis to develop your leakage profile.
- Conduct an Apparent Loss Component Analysis to develop your apparent loss profile.
- Cost-benefit analysis & target setting for water loss components.
- Design & implement water loss control program for cost-effective interventions.